Honeywell Docket No. H0003298 US - 4018
Buchalter Docket No.: H9925-2405

Inventor:	**Zhou et al.**
Serial No.:	**10/511454**
Filed:	**October 12, 2004**
For:	**THERMALLY CONDUCTIVE COATING COMPOSITIONS, METHODS OF PRODUCTION AND USES THEREOF**

Examiner: **Kuo L. Peng**
Art Unit: **1796**

MAIL STOP APPEAL BRIEF – PATENTS
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APPELLANT'S REPLY BRIEF UNDER 37 CFR § 41.41

This reply brief follows the Examiner's Answer dated October 26, 2007. The fees required under 37 CFR §1.17(f) are included with this brief.

This brief contains the following items under the headings in the order here indicated:

REAL PARTY IN INTEREST

The real party in interest is the assignee, Honeywell International Inc. (see Reel/Frame No. 014748/0566, Recorded on June 18, 2004)

RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences in this matter known to appellant.

STATUS OF THE CLAIMS

There are 64 claims in this case. Claims 1-64 are pending. Claims 1-64 were rejected as of the Final Office Action dated April 17, 2007. Claims 1-64 are being appealed.

STATUS OF AMENDMENTS

There have been no amendments filed subsequent to final rejection in this matter.

SUMMARY OF THE CLAIMED SUBJECT MATTER

The subject matter of the present application, including independent claims 1 and 35, is directed to thermally conductive coating compositions and material in electronic components, semiconductor components and other related layered materials applications.

A thermal interface composition is described in the application that includes: a) at least two siloxane-based compounds (page 8, lines 26-27, page 9, lines 1-22 and page 11, lines 9-17); b) at least one inorganic micro-filler material (page 11, lines 18-28, page 12, lines 1-3); and c) at least one thermally conductive filler material (page 12, lines 4-15).

Additionally, a method of forming a thermal interface material is disclosed herein that includes: a) providing at least two siloxane-based compounds (page 17, lines 16-26); b) providing at least one inorganic micro-filler material (page 17, lines 16-26); c) providing at least one thermally conductive filler material (page 17, lines 16-26); and d) combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler material (page 18, lines 1-25).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-10, 12-20, 25-44, 46-55 and 59-64 are rejected under 35 USC §102(e), as being anticipated by Matayabas (US 6469379).

Claims 1-14, 16, 18-20, 22-23, 25-48, 50, 52-57 and 59-64 are rejected under 35 USC §102(b), as being anticipated by Mine et al (US 6040362).

Claims 1-15, 17-26, 35-49 and 51-60 are rejected under 35 USC §102(b), as being anticipated by Theodore (US 4292225).

Claims 1-5, 8-10, 12-15, 17-18, 25-39, 43-44, 46-49, 51-52 and 59-64 are rejected under 35 USC §102(b), as being anticipated by Hanson (US 5950066).

Claims 21, 24, 55 and 58 are rejected under 35 USC §103(a) as unpatentable over Matayabas (US 6469379).

Claims 22 and 56 are rejected under 35 USC §103(a) as unpatentable over Matayabas (US 6469379) in view of Mine et al (US 6040362).

Claims 21 and 55 are rejected under 35 USC §103(a) as unpatentable over Hanson (US 5950066).

Claims 16 and 50 are rejected under 35 USC §103(a) as unpatentable over Hanson (US 5950066) in view of Matayabas (US Publication 2003/0168731).

ARGUMENT

ISSUE NO. 1 - §102(E) REJECTION OF CLAIMS BASED ON MATAYABAS '379 PATENT

Claims 1-10, 12-20, 25-44, 46-55 and 59-64 are rejected under 35 USC §102(e), as being anticipated by Matayabas (US 6469379). The Applicant respectfully disagrees.

Claim 1 recites:

"A thermal interface composition, comprising:

at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

at least one inorganic micro-filler material, and

at least one thermally conductive filler material."

Claim 35 recites:

"A method of forming a thermal interface material, comprising:

providing at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

providing at least one inorganic micro-filler material,

providing at least one thermally conductive filler material, and

combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler material."

Matayabas teaches a curable material useful as a thermal interface material comprising at least one vinyl-terminated silicone oil; at least one conductive filler; and at least one hydrogen terminated silicone oil. It is instructive to note that in Column 7 of the reference, lines 55-65, Matayabas states that low molecular weight silicone oil is beneficial to use in conjunction with the high molecular weight silicone polymers. This mixture apparently helps both the crosslinked polymer and the wettability. (see Column 5, lines 55-65)

Inorganic Fillers v. Thermally Conductive Fillers

First, it is important to note that Matayabas does not teach, describe or disclose providing at least one inorganic micro-filler material and providing at least one thermally conductive filler material followed by combining both in the thermal interface material. Matayabas only claims a thermally conductive filler material. Matayabas mentions that other materials may be added to improve the properties of the thermal interface material, but one of those materials isn't described as an inorganic micro-filler material. It is clear from page 5 of the Examiner's Answer that the Examiner is grouping the fillers of Matayabas into one group. ("Fillers such as copper, boron nitride, etc. can be used".)

The present application states that the inorganic micro-filler material is an important component after achieving phase separation of the at least two siloxane-based compounds. The specification describes the inorganic micro-filler material as:

> "may comprise silicon dioxide flakes or powder, silica powder or flakes or a combination thereof. Contemplated inorganic fillers comprise a chemical composition similar to that of silicon dioxide and is excessively blended into the coating composition. The filler is pre-coated with hexamethyldisilazane, which makes filler preferably compatible to only

> one type of polysiloxane. The flake-like filler also has a very small particle size (< 0.1 micro) and a large surface area."

The specification states that this inorganic micro-filler material is important because:

> "In theory, the phase separation of the two macro-monomers cooperated with the filler forms a hedge membrane on the top surface of silicone coating and essentially blocks the passageway of the monomers and oligomers migrating from both coating and GELVET® bases."

Matayabas does not claim or disclose this type of material in the thermal interface materials described in the '379 patent. In addition, its hard to imagine that Mayayabas would anticipate the claims of the present application, since they require the inorganic micro-filler material in order to achieve a useful product in combination with the desired phase separation of the organic materials.

Siloxane-Based Materials comprising Different Solubility Parameters

It appears from the Examiner's Answer that both the Applicant and the Examiner are looking at the same information from different perspectives. The Examiner considers that there are different solubility parameters inherent in using two different siloxane oils, as used in Matayabas. The Applicant is stating that, although that may be true that the two different siloxane oils have different solubility parameters in Matayabas, the solubility parameters are not such that there is a phase separation in Matayabas of the siloxane oils. In other words, two compounds having different solubility parameters does not mean that there will always be a phase separation effect, but instead may mean that they do not blend as well as other components would – its a

matter of degree. This fact is clear from Matayabas who discusses blending the oils to form the crosslinkable thermal interface material as one blended material.

The Applicant proposes to solve this predicament by amending claims 1 and 35 as follows:

Proposed Amended Claim 1 recites:

"A thermal interface composition, comprising:

at least two siloxane-based compounds, wherein each compound has a different solubility parameter in order to induce a phase separation between the at least two siloxane-based compounds,

at least one inorganic micro-filler material, and

at least one thermally conductive filler material."

Proposed Amended Claim 35 recites:

"A method of forming a thermal interface material, comprising:

providing at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

providing at least one inorganic micro-filler material,

providing at least one thermally conductive filler material, and

combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler material, such that a phase separation is induced between the at least two siloxane-based compounds."

If the Examiner believes that this option is acceptable, the Applicant will withdraw the Appeal through the filing of a Request for Continued Examination that includes the above amendments. It should be clear, however, that the Applicant is respectfully seeking to work with the Examiner in this case to move this matter forward to allowance, instead of wasting resources through the Appeal process. If, however, the Examiner does not agree with the Applicant's arguments or proposed amendments, then the Applicant is satisfied asking the Board to review the matter and make a reasoned recommendation or determination.

ISSUE NO. 2 - §102(B) REJECTION OF CLAIMS BASED ON MINE ET AL.

Claims 1-14, 16, 18-20, 22-23, 25-48, 50, 52-57 and 59-64 are rejected under 35 USC §102(b), as being anticipated by Mine et al (US 6040362). The Applicant respectfully disagrees.

Claim 1 recites:

"A thermal interface composition, comprising:

at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

at least one inorganic micro-filler material, and

at least one thermally conductive filler material."

Claim 35 recites:

"A method of forming a thermal interface material, comprising:

providing at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

providing at least one inorganic micro-filler material,

providing at least one thermally conductive filler material, and

combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler material."

Mine et al. does not anticipate the claims of the present application, because Mine does not recite at least two siloxane-based compounds, wherein each compound has a different solubility parameter. Anticipation generally requires the disclosure in a single prior art reference of each element of the claim under consideration. Further, the prior art reference must disclose each element of the claimed invention arranged as in the claim. Mine does not teach a thermal interface material or a method of making a thermal interface material comprising at least two siloxane-based compounds, wherein each compound has a different solubility parameter.

Siloxane-Based Materials comprising Different Solubility Parameters

It appears from the Examiner's Answer that both the Applicant and the Examiner are looking at the same information from different perspectives. The Examiner considers that there are different solubility parameters inherent in using two different silicon-alkenyl components, as used in Mine. The Applicant is stating that, although that may be true that the two different silicon-alkenyl components have different solubility parameters in Mine, the solubility parameters are not such that there is a phase separation in Mine of the silicon-alkenyl components. In other words, two compounds having different solubility parameters does not mean that there will always be a phase separation effect, but instead may mean that they do not blend as well as other components would – its a matter of degree.

The Applicant proposes to solve this predicament by amending claims 1 and 35 as follows:

Proposed Amended Claim 1 recites:

"A thermal interface composition, comprising:

at least two siloxane-based compounds, wherein each compound has a different solubility parameter in order to induce a phase separation between the at least two siloxane-based compounds,

at least one inorganic micro-filler material, and

at least one thermally conductive filler material."

Proposed Amended Claim 35 recites:

"A method of forming a thermal interface material, comprising:

providing at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

providing at least one inorganic micro-filler material,

providing at least one thermally conductive filler material, and

combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler material, such that a phase separation is induced between the at least two siloxane-based compounds."

If the Examiner believes that this option is acceptable, the Applicant will withdraw the Appeal through the filing of a Request for Continued Examination that includes the above amendments. It should be clear, however, that the Applicant is respectfully seeking to work with the Examiner in this case to move this matter forward to allowance, instead of wasting resources through the Appeal process. If, however, the Examiner does not agree with the Applicant's arguments or proposed amendments,

then the Applicant is satisfied asking the Board to review the matter and make a reasoned recommendation or determination.

<u>ISSUE NO. 3 - §102(B) REJECTION OF CLAIMS BASED ON THEODORE</u>

Claims 1-15, 17-26, 35-49 and 51-60 are rejected under 35 USC §102(b), as being anticipated by Theodore (US 4292225). The Applicant respectfully disagrees.

Claim 1 recites:

"A thermal interface composition, comprising:

at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

at least one inorganic micro-filler material, and

at least one thermally conductive filler material."

Claim 35 recites:

"A method of forming a thermal interface material, comprising:

providing at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

providing at least one inorganic micro-filler material,

providing at least one thermally conductive filler material, and

combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler material."

Theodore et al. does not anticipate the claims of the present application, because Theodore does not recite at least two siloxane-based compounds, wherein each compound has a different solubility parameter. Anticipation generally requires the disclosure in a single prior art reference of each element of the claim under consideration. Further, the prior art reference must disclose each element of the claimed invention arranged as in the claim. Theodore does not teach a thermal interface material or a method of making a thermal interface material comprising at least two siloxane-based compounds, wherein each compound has a different solubility parameter.

Siloxane-Based Materials comprising Different Solubility Parameters

It appears from the Examiner's Answer that both the Applicant and the Examiner are looking at the same information from different perspectives. The Examiner considers that there are different solubility parameters inherent in using two different siloxanes, as used in Theodore. The Applicant is stating that, although that may be true that the two different siloxanes have different solubility parameters in Theodore, the solubility parameters are not such that there is a phase separation in Theodore of the siloxanes. In other words, two compounds having different solubility parameters does not mean that there will always be a phase separation effect, but instead may mean that they do not blend as well as other components would – its a matter of degree.

The Applicant proposes to solve this predicament by amending claims 1 and 35 as follows:

Proposed Amended Claim 1 recites:

"A thermal interface composition, comprising:

at least two siloxane-based compounds, wherein each compound has a different solubility parameter <u>in order to induce a phase separation between the at least two siloxane-based compounds</u>,

at least one inorganic micro-filler material, and

at least one thermally conductive filler material."

Proposed Amended Claim 35 recites:

"A method of forming a thermal interface material, comprising:

providing at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

providing at least one inorganic micro-filler material,

providing at least one thermally conductive filler material, and

combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler material<u>, such that a phase separation is induced between the at least two siloxane-based compounds</u>."

If the Examiner believes that this option is acceptable, the Applicant will withdraw the Appeal through the filing of a Request for Continued Examination that includes the above amendments. It should be clear, however, that the Applicant is respectfully

seeking to work with the Examiner in this case to move this matter forward to allowance, instead of wasting resources through the Appeal process. If, however, the Examiner does not agree with the Applicant's arguments or proposed amendments, then the Applicant is satisfied asking the Board to review the matter and make a reasoned recommendation or determination.

ISSUE NO. 4 - §102(B) REJECTION OF CLAIMS BASED ON HANSON

Claims 1-5, 8-10, 12-15, 17-18, 25-39, 43-44, 46-49, 51-52 and 59-64 are rejected under 35 USC §102(b), as being anticipated by Hanson (US 5950066). The Applicant respectfully disagrees.

Claim 1 recites:

"A thermal interface composition, comprising:

at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

at least one inorganic micro-filler material, and

at least one thermally conductive filler material."

Claim 35 recites:

"A method of forming a thermal interface material, comprising:

providing at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

providing at least one inorganic micro-filler material,

providing at least one thermally conductive filler material, and

combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler material."

Hanson does not anticipate the claims of the present application, because Hanson does not recite at least two siloxane-based compounds, wherein each compound has a different solubility parameter. Anticipation generally requires the disclosure in a single prior art reference of each element of the claim under consideration. Further, the prior art reference must disclose each element of the claimed invention arranged as in the claim. Hanson does not teach a thermal interface material or a method of making a thermal interface material comprising at least two siloxane-based compounds, wherein each compound has a different solubility parameter.

Inorganic Fillers v. Thermally Conductive Fillers

First, it is important to note that Hanson does not teach, describe or disclose providing at least one inorganic micro-filler material and providing at least one thermally conductive filler material followed by combining both in the thermal interface material. Hanson only claims a thermally conductive filler material. Hanson mentions that other materials may be added to improve the properties of the thermal interface material, but one of those materials isn't described as an inorganic micro-filler material. It is clear from page 7 of the Examiner's Answer that the Examiner is grouping the fillers of Hanson into one group. ("Fillers such as alumina, boron nitride, metal powders, etc. and mixtures thereof".)

The present application states that the inorganic micro-filler material is an important component after achieving phase separation of the at least two siloxane-based compounds. The specification describes the inorganic micro-filler material as:

> "may comprise silicon dioxide flakes or powder, silica powder or flakes or a combination thereof. Contemplated inorganic fillers comprise a

> chemical composition similar to that of silicon dioxide and is excessively blended into the coating composition. The filler is pre-coated with hexamethyldisilazane, which makes filler preferably compatible to only one type of polysiloxane. The flake-like filler also has a very small particle size (< 0.1 micro) and a large surface area."

The specification states that this inorganic micro-filler material is important because:

> "In theory, the phase separation of the two macro-monomers cooperated with the filler forms a hedge membrane on the top surface of silicone coating and essentially blocks the passageway of the monomers and oligomers migrating from both coating and GELVET® bases."

Hanson does not claim or disclose this type of material in the thermal interface materials. In addition, its hard to imagine that Hanson would anticipate the claims of the present application, since they require the inorganic micro-filler material in order to achieve a useful product in combination with the desired phase separation of the organic materials.

Siloxane-Based Materials comprising Different Solubility Parameters

It appears from the Examiner's Answer that both the Applicant and the Examiner are looking at the same information from different perspectives. The Examiner considers that there are different solubility parameters inherent in using two different siloxanes, as used in Hanson. The Applicant is stating that, although that may be true that the two different siloxanes have different solubility parameters in Hanson, the solubility parameters are not such that there is a phase separation in Hanson of the siloxanes. In other words, two compounds having different solubility parameters does

not mean that there will always be a phase separation effect, but instead may mean that they do not blend as well as other components would – its a matter of degree.

The Applicant proposes to solve this predicament by amending claims 1 and 35 as follows:

Proposed Amended Claim 1 recites:

"A thermal interface composition, comprising:

at least two siloxane-based compounds, wherein each compound has a different solubility parameter <u>in order to induce a phase separation between the at least two siloxane-based compounds</u>,

at least one inorganic micro-filler material, and

at least one thermally conductive filler material."

Proposed Amended Claim 35 recites:

"A method of forming a thermal interface material, comprising:

providing at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

providing at least one inorganic micro-filler material,

providing at least one thermally conductive filler material, and

combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler material<u>, such that a phase separation is induced between the at least two siloxane-based compounds</u>."

If the Examiner believes that this option is acceptable, the Applicant will withdraw the Appeal through the filing of a Request for Continued Examination that includes the above amendments. It should be clear, however, that the Applicant is respectfully seeking to work with the Examiner in this case to move this matter forward to allowance, instead of wasting resources through the Appeal process. If, however, the Examiner does not agree with the Applicant's arguments or proposed amendments, then the Applicant is satisfied asking the Board to review the matter and make a reasoned recommendation or determination.

ISSUE NO. 5 - §103(A) REJECTION OF CLAIMS BASED ON MATAYABAS

Claims 21, 24, 55 and 58 are rejected under 35 USC §103(a) as unpatentable over Matayabas (US 6469379). The Applicant respectfully disagrees.

Procedurally, this rejection is inappropriate for two reasons. First, all of the claims cited in the 103(a) rejections are dependent claims. Independent claims 1 and 35 are not cited as being obvious in view of these references – and therefore, they are allowable. Since they are allowable, the dependant claims to which they refer are also allowable. Second, claims are not obvious in view of only one reference, but instead in view of a combination of references. If there is only one reference cited, it should properly be cited as a reference which anticipates the claims cited and not renders obvious those same claims.

In order to expedite prosecution of this application, however, the Applicants will address the references.

Claim 1 recites:

"A thermal interface composition, comprising:

at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

at least one inorganic micro-filler material, and

at least one thermally conductive filler material."

Claim 35 recites:

"A method of forming a thermal interface material, comprising:

providing at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

providing at least one inorganic micro-filler material,

providing at least one thermally conductive filler material, and

combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler material."

Matayabas teaches a curable material useful as a thermal interface material comprising at least one vinyl-terminated silicone oil; at least one conductive filler; and at least one hydrogen terminated silicone oil. It is instructive to note that in Column 7 of the reference, lines 55-65, Matayabas states that low molecular weight silicone oil is beneficial to use in conjunction with the high molecular weight silicone polymers. This mixture apparently helps both the crosslinked polymer and the wettability. (see Column 5, lines 55-65)

Inorganic Fillers v. Thermally Conductive Fillers

First, it is important to note that Matayabas does not teach, describe or disclose providing at least one inorganic micro-filler material and providing at least one thermally conductive filler material followed by combining both in the thermal interface material. Matayabas only claims a thermally conductive filler material. Matayabas mentions that other materials may be added to improve the properties of the thermal interface material, but one of those materials isn't described as an inorganic micro-filler material.

It is clear from page 5 of the Examiner's Answer that the Examiner is grouping the fillers of Matayabas into one group. ("Fillers such as copper, boron nitride, etc. can be used".)

The present application states that the inorganic micro-filler material is an important component after achieving phase separation of the at least two siloxane-based compounds. The specification describes the inorganic micro-filler material as:

> "may comprise silicon dioxide flakes or powder, silica powder or flakes or a combination thereof. Contemplated inorganic fillers comprise a chemical composition similar to that of silicon dioxide and is excessively blended into the coating composition. The filler is pre-coated with hexamethyldisilazane, which makes filler preferably compatible to only one type of polysiloxane. The flake-like filler also has a very small particle size (< 0.1 micro) and a large surface area."

The specification states that this inorganic micro-filler material is important because:

> "In theory, the phase separation of the two macro-monomers cooperated with the filler forms a hedge membrane on the top surface of silicone coating and essentially blocks the passageway of the monomers and oligomers migrating from both coating and GELVET® bases."

Matayabas does not claim or disclose this type of material in the thermal interface materials described in the '379 patent. In addition, its hard to imagine that Mayayabas would render obvious the claims of the present application, since they require the inorganic micro-filler material in order to achieve a useful product in combination with the desired phase separation of the organic materials, and it is doubtful that one of ordinary skill in the art would arrive at the claims of the present application after a fair reading of Matayabas.

Siloxane-Based Materials comprising Different Solubility Parameters

It appears from the Examiner's Answer that both the Applicant and the Examiner are looking at the same information from different perspectives. The Examiner considers that there are different solubility parameters inherent in using two different siloxane oils, as used in Matayabas. The Applicant is stating that, although that may be true that the two different siloxane oils have different solubility parameters in Matayabas, the solubility parameters are not such that there is a phase separation in Matayabas of the siloxane oils. In other words, two compounds having different solubility parameters does not mean that there will always be a phase separation effect, but instead may mean that they do not blend as well as other components would – its a matter of degree. This fact is clear from Matayabas who discusses blending the oils to form the crosslinkable thermal interface material as one blended material.

The Applicant proposes to solve this predicament by amending claims 1 and 35 as follows:

Proposed Amended Claim 1 recites:

"A thermal interface composition, comprising:

at least two siloxane-based compounds, wherein each compound has a different solubility parameter in order to induce a phase separation between the at least two siloxane-based compounds,

at least one inorganic micro-filler material, and

at least one thermally conductive filler material."

Proposed Amended Claim 35 recites:

"A method of forming a thermal interface material, comprising:

providing at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

providing at least one inorganic micro-filler material,

providing at least one thermally conductive filler material, and

combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler material<u>, such that a phase separation is induced between the at least two siloxane-based compounds</u>."

If the Examiner believes that this option is acceptable, the Applicant will withdraw the Appeal through the filing of a Request for Continued Examination that includes the above amendments. It should be clear, however, that the Applicant is respectfully seeking to work with the Examiner in this case to move this matter forward to allowance, instead of wasting resources through the Appeal process. If, however, the Examiner does not agree with the Applicant's arguments or proposed amendments, then the Applicant is satisfied asking the Board to review the matter and make a reasoned recommendation or determination.

ISSUE NO. 6 - §103(A) REJECTION OF CLAIMS BASED ON MATAYABAS IN VIEW OF MINE

Claims 22 and 56 are rejected under 35 USC §103(a) as unpatentable over Matayabas (US 6469379) in view of Mine et al (US 6040362). The Applicant respectfully disagrees.

Procedurally, this rejection is inappropriate. All of the claims cited in the 103(a) rejection are dependent claims. Independent claims 1 and 35 are not cited as being obvious in view of these references – and therefore, they are allowable. Since they are allowable, the dependant claims to which they refer are also allowable.

In order to expedite prosecution of this application, however, the Applicants will address the references.

Claim 1 recites:

"A thermal interface composition, comprising:

at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

at least one inorganic micro-filler material, and

at least one thermally conductive filler material."

Claim 35 recites:

"A method of forming a thermal interface material, comprising:

providing at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

providing at least one inorganic micro-filler material,

providing at least one thermally conductive filler material, and

combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler material."

Matayabas teaches a curable material useful as a thermal interface material comprising at least one vinyl-terminated silicone oil; at least one conductive filler; and at least one hydrogen terminated silicone oil. It is instructive to note that in Column 7 of the reference, lines 55-65, Matayabas states that low molecular weight silicone oil is beneficial to use in conjunction with the high molecular weight silicone polymers. This mixture apparently helps both the crosslinked polymer and the wettability. (see Column 5, lines 55-65)

Inorganic Fillers v. Thermally Conductive Fillers

First, it is important to note that Matayabas does not teach, describe or disclose providing at least one inorganic micro-filler material and providing at least one thermally conductive filler material followed by combining both in the thermal interface material. Matayabas only claims a thermally conductive filler material. Matayabas mentions that other materials may be added to improve the properties of the thermal interface material, but one of those materials isn't described as an inorganic micro-filler material. It is clear from page 5 of the Examiner's Answer that the Examiner is grouping the fillers of Matayabas into one group. ("Fillers such as copper, boron nitride, etc. can be used".)

The present application states that the inorganic micro-filler material is an important component after achieving phase separation of the at least two siloxane-based compounds. The specification describes the inorganic micro-filler material as:

> "may comprise silicon dioxide flakes or powder, silica powder or flakes or a combination thereof. Contemplated inorganic fillers comprise a chemical composition similar to that of silicon dioxide and is excessively blended into the coating composition. The filler is pre-coated with hexamethyldisilazane, which makes filler preferably compatible to only one type of polysiloxane. The flake-like filler also has a very small particle size (< 0.1 micro) and a large surface area."

The specification states that this inorganic micro-filler material is important because:

> "In theory, the phase separation of the two macro-monomers cooperated with the filler forms a hedge membrane on the top surface of silicone coating and essentially blocks the passageway of the monomers and oligomers migrating from both coating and GELVET® bases."

Matayabas does not claim or disclose this type of material in the thermal interface materials described in the '379 patent. In addition, its hard to imagine that Mayayabas would render obvious the claims of the present application, since they require the inorganic micro-filler material in order to achieve a useful product in combination with the desired phase separation of the organic materials, and it is doubtful that one of ordinary skill in the art would arrive at the claims of the present application after a fair reading of Matayabas.

Siloxane-Based Materials comprising Different Solubility Parameters

It appears from the Examiner's Answer that both the Applicant and the Examiner are looking at the same information from different perspectives. The Examiner considers that there are different solubility parameters inherent in using two different siloxane oils, as used in Matayabas, or the silicon-alkenyl components shown in Mine. The Applicant is stating that, although that may be true that the two different siloxane oils have different solubility parameters in Matayabas or Mine, the solubility parameters are not such that there is a phase separation in Matayabas of the siloxane oils or Mine of the silicon-alkenyl components. In other words, two compounds having different solubility parameters does not mean that there will always be a phase separation effect, but instead may mean that they do not blend as well as other components would – its a matter of degree. This fact is clear from Matayabas who discusses blending the oils to form the crosslinkable thermal interface material as one blended material.

The Applicant proposes to solve this predicament by amending claims 1 and 35 as follows:

Proposed Amended Claim 1 recites:

"A thermal interface composition, comprising:

at least two siloxane-based compounds, wherein each compound has a different solubility parameter in order to induce a phase separation between the at least two siloxane-based compounds,

at least one inorganic micro-filler material, and

at least one thermally conductive filler material."

Proposed Amended Claim 35 recites:

"A method of forming a thermal interface material, comprising:

providing at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

providing at least one inorganic micro-filler material,

providing at least one thermally conductive filler material, and

combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler material, <u>such that a phase separation is induced between the at least two siloxane-based compounds</u>."

If the Examiner believes that this option is acceptable, the Applicant will withdraw the Appeal through the filing of a Request for Continued Examination that includes the above amendments. It should be clear, however, that the Applicant is respectfully seeking to work with the Examiner in this case to move this matter forward to allowance, instead of wasting resources through the Appeal process. If, however, the Examiner does not agree with the Applicant's arguments or proposed amendments, then the Applicant is satisfied asking the Board to review the matter and make a reasoned recommendation or determination.

ISSUE NO. 7 - §103(A) REJECTION OF CLAIMS BASED ON HANSON

Claims 21 and 55 are rejected under 35 USC §103(a) as unpatentable over Hanson (US 5950066). The Applicant respectfully disagrees.

Procedurally, this rejection is inappropriate for two reasons. First, all of the claims cited in the 103(a) rejections are dependent claims. Independent claims 1 and 35 are not cited as being obvious in view of these references – and therefore, they are allowable. Since they are allowable, the dependant claims to which they refer are also allowable. Second, claims are not obvious in view of only one reference, but instead in view of a combination of references. If there is only one reference cited, it should properly be cited as a reference which anticipates the claims cited and not renders obvious those same claims.

In order to expedite prosecution of this application, however, the Applicants will address the references.

Claim 1 recites:

"A thermal interface composition, comprising:

at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

at least one inorganic micro-filler material, and

at least one thermally conductive filler material."

Claim 35 recites:

"A method of forming a thermal interface material, comprising:

providing at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

providing at least one inorganic micro-filler material,

providing at least one thermally conductive filler material, and

combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler material."

Inorganic Fillers v. Thermally Conductive Fillers

First, it is important to note that Hanson does not teach, describe or disclose providing at least one inorganic micro-filler material and providing at least one thermally conductive filler material followed by combining both in the thermal interface material. Hanson only claims a thermally conductive filler material. Hanson mentions that other materials may be added to improve the properties of the thermal interface material, but one of those materials isn't described as an inorganic micro-filler material. It is clear from page 7 of the Examiner's Answer that the Examiner is grouping the fillers of Hanson into one group. ("Fillers such as alumina, boron nitride, metal powders, etc. and mixtures thereof".)

The present application states that the inorganic micro-filler material is an important component after achieving phase separation of the at least two siloxane-based compounds. The specification describes the inorganic micro-filler material as:

> "may comprise silicon dioxide flakes or powder, silica powder or flakes or a combination thereof. Contemplated inorganic fillers comprise a chemical composition similar to that of silicon dioxide and is excessively blended into the coating composition. The filler is pre-coated with hexamethyldisilazane, which makes filler preferably compatible to only one type of polysiloxane. The flake-like filler also has a very small particle size (< 0.1 micro) and a large surface area."

The specification states that this inorganic micro-filler material is important because:

> "In theory, the phase separation of the two macro-monomers cooperated with the filler forms a hedge membrane on the top surface of silicone coating and essentially blocks the passageway of the monomers and oligomers migrating from both coating and GELVET® bases."

Hanson does not claim or disclose this type of material in the thermal interface materials. In addition, its hard to imagine that Hanson would render obvious the claims of the present application, since they require the inorganic micro-filler material in order to achieve a useful product in combination with the desired phase separation of the organic materials.

Siloxane-Based Materials comprising Different Solubility Parameters

It appears from the Examiner's Answer that both the Applicant and the Examiner are looking at the same information from different perspectives. The Examiner considers that there are different solubility parameters inherent in using two different siloxanes, as used in Hanson. The Applicant is stating that, although that may be true that the two different siloxanes have different solubility parameters in Hanson, the

solubility parameters are not such that there is a phase separation in Hanson of the siloxanes. In other words, two compounds having different solubility parameters does not mean that there will always be a phase separation effect, but instead may mean that they do not blend as well as other components would – its a matter of degree.

The Applicant proposes to solve this predicament by amending claims 1 and 35 as follows:

Proposed Amended Claim 1 recites:

"A thermal interface composition, comprising:

at least two siloxane-based compounds, wherein each compound has a different solubility parameter <u>in order to induce a phase separation between the at least two siloxane-based compounds</u>,

at least one inorganic micro-filler material, and

at least one thermally conductive filler material."

Proposed Amended Claim 35 recites:

"A method of forming a thermal interface material, comprising:

providing at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

providing at least one inorganic micro-filler material,

providing at least one thermally conductive filler material, and

combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler

material, such that a phase separation is induced between the at least two siloxane-based compounds."

If the Examiner believes that this option is acceptable, the Applicant will withdraw the Appeal through the filing of a Request for Continued Examination that includes the above amendments. It should be clear, however, that the Applicant is respectfully seeking to work with the Examiner in this case to move this matter forward to allowance, instead of wasting resources through the Appeal process. If, however, the Examiner does not agree with the Applicant's arguments or proposed amendments, then the Applicant is satisfied asking the Board to review the matter and make a reasoned recommendation or determination.

ISSUE NO. 8 - §103(A) REJECTION OF CLAIMS BASED ON HANSON IN VIEW OF MATAYABAS

Claims 16 and 50 are rejected under 35 USC §103(a) as unpatentable over Hanson (US 5950066) in view of Matayabas (US 2003/0168731). The Applicant respectfully disagrees.

Procedurally, this rejection is inappropriate. All of the claims cited in the 103(a) rejection are dependent claims. Independent claims 1 and 35 are not cited as being obvious in view of these references – and therefore, they are allowable. Since they are allowable, the dependant claims to which they refer are also allowable.

In order to expedite prosecution of this application, however, the Applicants will address the references.

Claim 1 recites:

"A thermal interface composition, comprising:

at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

at least one inorganic micro-filler material, and

at least one thermally conductive filler material."

Claim 35 recites:

"A method of forming a thermal interface material, comprising:

providing at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

providing at least one inorganic micro-filler material,

providing at least one thermally conductive filler material, and

combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler material."

Matayabas teaches a curable material useful as a thermal interface material comprising at least one vinyl-terminated silicone oil; at least one conductive filler; and at least one hydrogen terminated silicone oil.

Inorganic Fillers v. Thermally Conductive Fillers

First, it is important to note that Matayabas does not teach, describe or disclose providing at least one inorganic micro-filler material and providing at least one thermally conductive filler material followed by combining both in the thermal interface material. Matayabas only claims a thermally conductive filler material. Matayabas mentions that other materials may be added to improve the properties of the thermal interface material, but one of those materials isn't described as an inorganic micro-filler material.

The present application states that the inorganic micro-filler material is an important component after achieving phase separation of the at least two siloxane-based compounds. The specification describes the inorganic micro-filler material as:

"may comprise silicon dioxide flakes or powder, silica powder or flakes or a combination thereof. Contemplated inorganic fillers comprise a

> chemical composition similar to that of silicon dioxide and is excessively blended into the coating composition. The filler is pre-coated with hexamethyldisilazane, which makes filler preferably compatible to only one type of polysiloxane. The flake-like filler also has a very small particle size (< 0.1 micro) and a large surface area."

The specification states that this inorganic micro-filler material is important because:

> "In theory, the phase separation of the two macro-monomers cooperated with the filler forms a hedge membrane on the top surface of silicone coating and essentially blocks the passageway of the monomers and oligomers migrating from both coating and GELVET® bases."

Matayabas does not claim or disclose this type of material in the thermal interface materials described in the '731 publication. In addition, its hard to imagine that Matayabas would render obvious the claims of the present application, since they require the inorganic micro-filler material in order to achieve a useful product in combination with the desired phase separation of the organic materials, and it is doubtful that one of ordinary skill in the art would arrive at the claims of the present application after a fair reading of Matayabas.

Siloxane-Based Materials comprising Different Solubility Parameters

It appears from the Examiner's Answer that both the Applicant and the Examiner are looking at the same information from different perspectives. The Examiner considers that there are different solubility parameters inherent in using two different siloxane oils, as used in Matayabas. The Applicant is stating that, although that may be true that the two different siloxane oils have different solubility parameters in

Matayabas, the solubility parameters are not such that there is a phase separation in Matayabas of the siloxane oils. In other words, two compounds having different solubility parameters does not mean that there will always be a phase separation effect, but instead may mean that they do not blend as well as other components would – its a matter of degree. This fact is clear from Matayabas who discusses blending the oils to form the crosslinkable thermal interface material as one blended material.

The Applicant proposes to solve this predicament by amending claims 1 and 35 as follows:

Proposed Amended Claim 1 recites:

"A thermal interface composition, comprising:

at least two siloxane-based compounds, wherein each compound has a different solubility parameter <u>in order to induce a phase separation between the at least two siloxane-based compounds</u>,

at least one inorganic micro-filler material, and

at least one thermally conductive filler material."

Proposed Amended Claim 35 recites:

"A method of forming a thermal interface material, comprising:

providing at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

providing at least one inorganic micro-filler material,

providing at least one thermally conductive filler material, and

combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler material, such that a phase separation is induced between the at least two siloxane-based compounds."

If the Examiner believes that this option is acceptable, the Applicant will withdraw the Appeal through the filing of a Request for Continued Examination that includes the above amendments. It should be clear, however, that the Applicant is respectfully seeking to work with the Examiner in this case to move this matter forward to allowance, instead of wasting resources through the Appeal process. If, however, the Examiner does not agree with the Applicant's arguments or proposed amendments, then the Applicant is satisfied asking the Board to review the matter and make a reasoned recommendation or determination.

Respectfully submitted,
Buchalter Nemer, A Prof. Corporation

Dated: December 26, 2007 By: Sandra Thompson

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APPENDIX OF PENDING CLAIMS

1. (Previously Presented) A thermal interface composition, comprising:

at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

at least one inorganic micro-filler material, and

at least one thermally conductive filler material.

2. (Previously Presented) The thermal interface composition of claim 1, wherein at least one of the siloxane-based compounds comprises a polysiloxane compound.

3. (Previously Presented) The thermal interface composition of claim 1, wherein at least one of the siloxane-based compounds comprises a hydride-functional siloxane compound.

4. (Previously Presented) The thermal interface composition of claim 2, wherein the polysiloxane compound comprises a substituted polysiloxane compound.

5. (Previously Presented) The thermal interface composition of claim 4, wherein the polysiloxane compound is substituted by a functional group comprising an alkyl group, an aromatic group, a halide group or combinations thereof.

6. (Previously Presented) The thermal interface composition of claim 4, wherein the substituted polysiloxane compound comprises an alkenyl-terminated polyalkylsiloxane.

7. (Previously Presented) The thermal interface composition of claim 6, wherein the alkenyl-terminated polyalkylsiloxane comprises a vinyl group.

8. (Previously Presented) The thermal interface composition of claim 7, wherein the alkenyl-terminated polyalkylsiloxane further comprises a methyl group.

9. (Previously Presented) The thermal interface composition of claim 5, wherein the polysiloxane compound comprises vinylmethylcyclotetrasiloxane,

polytetradecylmethylsiloxane, polyoctylmethylsiloxane, decylmethylsiloxane, butylated aryloxy-propylmethylsiloxane, octadecylmethylsiloxane, dimethylsiloxane or combinations thereof.

10. (Previously Presented) The thermal interface composition of claim 3, wherein the hydride-functional siloxane comprises methylhydrosiloxane.

11. (Previously Presented) The thermal interface composition of claim 1, wherein the inorganic micro-filler material comprises silicon dioxide.

12. (Previously Presented) The thermal interface composition of claim 1, wherein the inorganic micro-filler material comprises a powder.

13. (Previously Presented) The thermal interface composition of claim 1, wherein the inorganic micro-filler material comprises a flake.

14. (Previously Presented) The thermal interface composition of claim 1, wherein the thermally conductive filler material comprises a transition metal.

15. (Previously Presented) The thermal interface composition of claim 1, wherein the thermally conductive filler material comprises boron.

16. (Previously Presented) The thermal interface composition of claim 14, wherein the transition metal comprises copper.

17. (Previously Presented) The thermal interface composition of claim 15, wherein the thermally conductive filler material comprises boron nitride.

18. (Previously Presented) The thermal interface material of claim 1, further comprising at least one additive.

19. (Previously Presented) The thermal interface material of claim 18, wherein the additive comprises a catalyst.

20. (Previously Presented) The thermal interface material of claim 18, wherein the additive comprises an inhibitor.

21. (Previously Presented) The thermal interface material of claim 18, wherein the additive comprises a rheological modifier.

22. (Previously Presented) The thermal interface composition of claim 19, wherein the catalyst comprises platinum.

23. (Previously Presented) The thermal interface composition of claim 20, wherein the inhibitor comprises an antioxidant.

24. (Previously Presented) The thermal interface composition of claim 21, wherein the rheological modifier comprises at least one solvent.

25. (Previously Presented) A coating composition comprising the thermal interface composition of claim 1.

26. (Previously Presented) A coating composition comprising the thermal interface composition of claim 18.

27. (Previously Presented) An electronic component comprising the thermal interface composition of claim 1.

28. (Previously Presented) An electronic component comprising the thermal interface composition of claim 18.

29. (Previously Presented) An electronic component comprising the coating solution of claim 25.

30. (Previously Presented) An electronic component comprising the coating solution of claim 26.

31. (Previously Presented) A semiconductor component comprising the thermal interface composition of claim 1.

32. (Previously Presented) A semiconductor component comprising the thermal interface composition of claim 18.

33. (Previously Presented) A semiconductor component comprising the coating solution of claim 25.

34. (Previously Presented) A semiconductor component comprising the coating solution of claim 26.

35. (Previously Presented) A method of forming a thermal interface material, comprising:

providing at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

providing at least one inorganic micro-filler material,

providing at least one thermally conductive filler material, and

combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler material.

36. (Previously Presented) The method of claim 35, wherein at least one of the siloxane-based compounds comprises a polysiloxane compound.

37. (Previously Presented) The method of claim 35, wherein at least one of the siloxane-based compounds comprises a hydride-functional siloxane compound.

38. (Previously Presented) The method of claim 36, wherein the polysiloxane compound comprises a substituted polysiloxane compound.

39. (Previously Presented) The method of claim 38, wherein the polysiloxane compound is substituted by a functional group comprising an alkyl group, an aromatic group, a halide group or combinations thereof.

40. (Previously Presented) The method of claim 38, wherein the substituted polysiloxane compound comprises an alkenyl-terminated polyalkylsiloxane.

41. (Previously Presented) The method of claim 40, wherein the alkenyl-terminated polyalkylsiloxane comprises a vinyl group.

42. (Previously Presented) The method of claim 41, wherein the alkenyl-terminated polyalkylsiloxane further comprises a methyl group.

43. (Previously Presented) The method of claim 39, wherein the polysiloxane compound comprises vinylmethylcyclotetrasiloxane, polytetradecylmethylsiloxane, polyoctylmethylsiloxane, decylmethylsiloxane, butylated aryloxy-propylmethylsiloxane, octadecylmethylsiloxane, dimethylsiloxane or combinations thereof.

44. (Previously Presented) The method of claim 37, wherein the hydride-functional siloxane comprises methylhydrosiloxane.

45. (Previously Presented) The method of claim 35, wherein the inorganic micro-filler material comprises silicon dioxide.

46. (Previously Presented) The method of claim 35, wherein the inorganic micro-filler material comprises a powder.

47. (Previously Presented) The method of claim 35, wherein the inorganic micro-filler material comprises a flake.

48. (Previously Presented) The method of claim 35, wherein the thermally conductive filler material comprises a transition metal.

49. (Previously Presented) The method of claim 35, wherein the thermally conductive filler material comprises boron.

50. (Previously Presented) The method of claim 48, wherein the transition metal comprises copper.

51. (Previously Presented) The method of claim 49, wherein the thermally conductive filler material comprises boron nitride.

52. (Previously Presented) The method of claim 35, further comprising at least one additive.

53. (Previously Presented) The method of claim 52, wherein the additive comprises a catalyst.

54. (Previously Presented) The method of claim 52, wherein the additive comprises an inhibitor.

55. (Previously Presented) The method of claim 52, wherein the additive comprises a rheological modifier.

56. (Previously Presented) The method of claim 53, wherein the catalyst comprises platinum.

57. (Previously Presented) The method of claim 54, wherein the inhibitor comprises an antioxidant.

58. (Previously Presented) The method of claim 55, wherein the rheological modifier comprises at least one solvent.

59. (Previously Presented) A coating composition produced from the method of claim 35.

60. (Previously Presented) A coating composition produced from the method of claim 52.

61. (Previously Presented) An electronic component comprising the coating solution of claim 59.

62. (Previously Presented) An electronic component comprising the coating solution of claim 60.

63. (Previously Presented) A semiconductor component comprising the coating solution of claim 59.

64. (Previously Presented) A semiconductor component comprising the coating solution of claim 60.

EVIDENCE APPENDIX

There is no additional evidence at this time of which the Applicant's are aware.

RELATED PROCEEDINGS APPENDIX

There are no related proceedings at this time of which the Applicant's are aware.